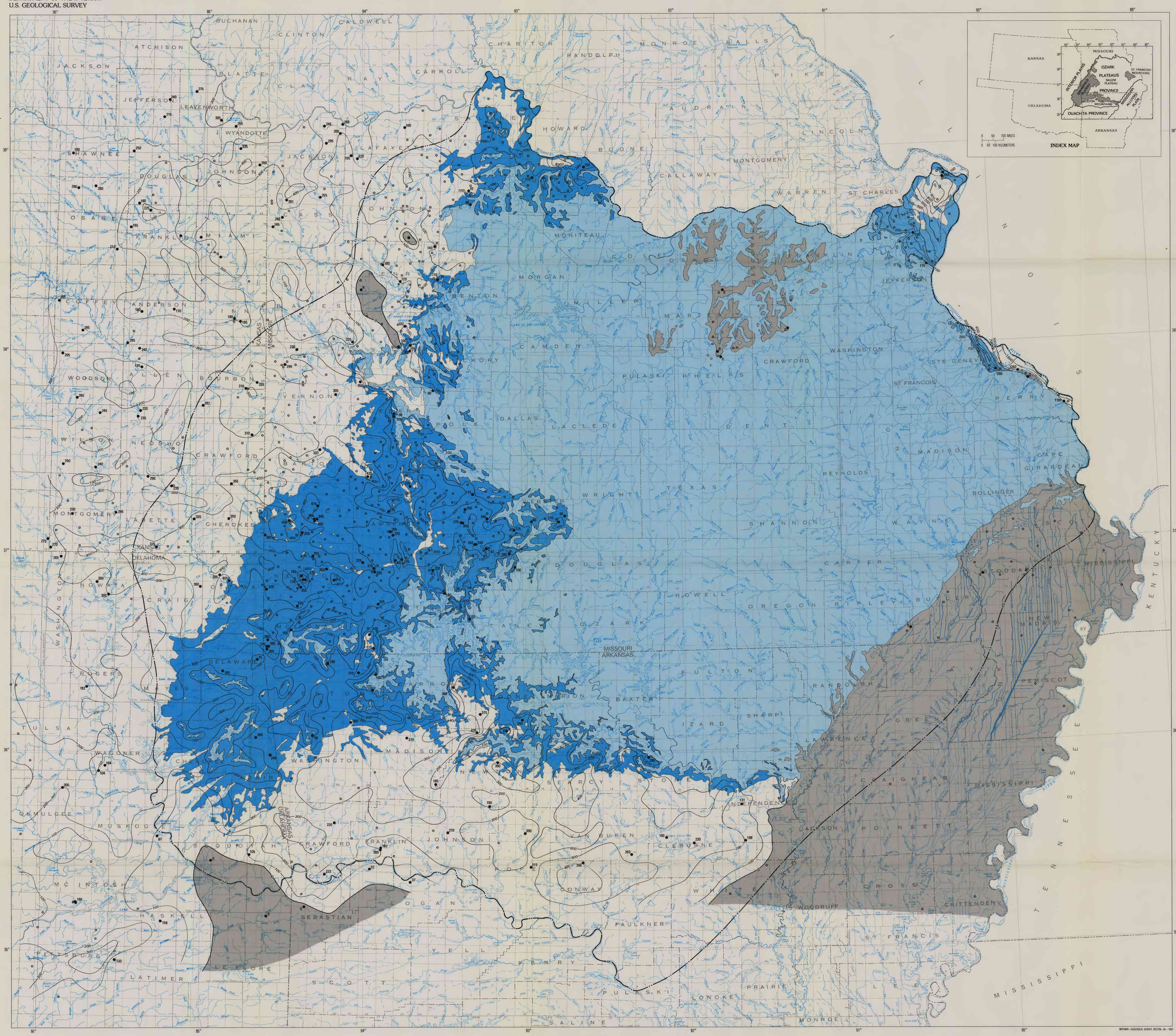
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA–711–G (SHEET 2 OF 3)



EXPLANATION

- Outcrop area of Springfield Plateau aquifer
- Outcrop area of unnamed geohydrologic units that are stratigraphically equivalent to the Springfield Plateau aquifer (see text)
- Outcrop area of rocks comprising geohydrologic units older than Springfield Plateau aquifer
- Area where Springfield Plateau aquifer and stratigraphically equivalent units are missing in subsurface
- Contact
- Approximate boundary of Ozark Plateaus aquifer system
- 0—200 Line of equal thickness of Springfield Plateau aquifer and stratigraphically equivalent units[1]—Lines in areas of few control points are consistent with thickness data calculated from digital representations of altitude of top of Springfield Plateau aquifer and stratigraphically equivalent units and altitude of top of underlying Ozark confining unit. Interval, in feet, is variable
- 325 Control data point[1]—Part of Central Midwest Regional Aquifer-System Analysis data base. Number is thickness, in feet, of Springfield Plateau aquifer and stratigraphically equivalent geologic units
- Auxiliary control data point[1]

[1]Lines and control points beyond the boundary of the Ozark Plateaus aquifer system are for units stratigraphically equivalent to those of the Ozark Plateaus aquifer system

THICKNESS

To the west and south, the Springfield Plateau aquifer thickens abruptly at the edge of the Salem Plateau and at the edge of small, isolated outcrops of stratigraphically lower geohydrologic units, then maintains a relative uniform thickness of 100 to 400 feet throughout the Ozark Plateaus province. The aquifer gradually thickens to the northwest and is missing in the subsurface from two small areas near the western border of the Springfield Plateau in Johnson, Henry, and St. Clair Counties, Missouri. The aquifer also is missing in the subsurface at the southwestern edge of the Ozark Plateaus aquifer system. This area in Oklahoma is part of a larger area that straddles the Oklahoma-Arkansas border where stratigraphic units equivalent to the Springfield Plateau aquifer are missing south of the Ozark Plateaus province.

Rocks that are stratigraphically equivalent and have similar hydrologic properties to the Springfield Plateau aquifer thicken abruptly to the east, attaining a thickness of more than 1,500 feet within a few miles in Ste. Genevieve and Perry Counties, Missouri. In St. Louis County the rocks appear to form a large lens that is more than 900 feet thick at its center.

HYDRAULIC CHARACTERISTICS AND LITHOLOGY

The characteristic that identifies a geohydrologic unit as an aquifer is its ability to yield usable quantities of water to wells relative to that which is available from surrounding rocks. Two physical properties of the rock indicate its ability to yield water, storage coefficient and transmissivity. The storage coefficient of an aquifer is a measure of its capacity to store water and is directly proportional to the porosity of the rocks that comprise the aquifer. The transmissivity (T=Kb) of the aquifer, defined as the product of the hydraulic conductivity (K) and thickness (b), determines the rate at which water can move through the aquifer. The hydraulic conductivity is a function of several physical properties of the aquifer, including lithology, primary porosity of the rocks, the development of post-depositional solution channels, karst, and the presence of fracture and fault systems, and physical properties of water in the aquifer. In the absence of extensive fracturing, the presence of shale (a relatively impermeable material) may significantly decrease the transmissive properties of the aquifer. The transmissive and storage properties of a regional aquifer, such as the Springfield Plateau aquifer, may vary considerably from one area to another. Because municipal and other large-capacity wells that penetrate the Springfield Plateau aquifer also are open to the more permeable Ozark aquifer, attempt was made to estimate the hydraulic conductivity of the Springfield Plateau aquifer from specific-capacity data.

The Springfield Plateau aquifer primarily consists of limestone of Mississippian age. The rocks of this geohydrologic unit commonly contain a large percentage of chert. In southwestern Missouri and southeastern Kansas, the more important geologic units in the aquifer, due to both their relatively greater thickness and permeability, are the Burlington and Keokuk Limestones. The two formations have similar lithologies: medium- to coarsely-crystalline bedded limestone containing abundant quantities of gray chert, mainly in the form of nodules. Dissolution of the readily soluble limestone along bedding planes and fracture traces has created an extensive network of solution channels. In many areas these solution channels have enlarged to the point where the rock matrix has collapsed, ultimately producing caves and other large karst features. Thus, the permeability of the Burlington and Keokuk Limestones can be large. The underlying Fern Glen Limestone and Pierson Formation are not as thick as the Burlington and Keokuk Limestones and do not contain an extensive network of solution channels. However, the formations probably are moderately permeable. Geologic units that overlie the Burlington and Keokuk Limestones are not widespread in southwestern Missouri and southeastern Kansas. Where they are present, their permeability is reduced due to lack of solution-channel development and the presence of shale.

In the extreme southwestern part of the Ozark Plateaus province, the Springfield Plateau aquifer is composed of geologic units ranging from the basal Boone Formation to the Moorefield Formation. The Boone Formation is lithologically and hydrologically similar to the Burlington and Keokuk Limestones of southwestern Missouri and southeastern Kansas. The Boone also generally contains a large chert content, except in a basal member (St. Joe Limestone Member) that is relatively chert free. The overlying Reeds Spring Member of the Boone Formation and the overlying Keokuk Limestone have similar lithologies in the southwestern part of the Ozark Plateaus province. They consist of dense, fine-grained limestone and massive gray chert. The chert content of the Keokuk Limestone is much greater than that of the Reed Springs and is of sufficient quantity and density to make these rocks less permeable than the Boone Formation. The Moorefield Formation, which grades from argillaceous limestone to siltstone and shale, probably does not contribute significantly to the transmissivity of the Springfield Plateau aquifer.

In northern Arkansas, the Springfield Plateau aquifer is represented by only the Boone Formation. The chert content of the Boone Formation increases from west to east, but the formation remains permeable due to dissolution along bedding planes and fractures.

Base from U.S. Geological Survey
State base maps, 1:500,000: Arkansas, 1967; Kansas, 1983; Missouri, 1973; Oklahoma, 1972

SCALE 1:750 000

25 0 25 50 75 100 MILES
25 0 25 50 75 100 KILOMETERS

Thickness of Springfield Plateau aquifer

MAJOR GEOHYDROLOGIC UNITS IN AND ADJACENT TO THE OZARK PLATEAUS PROVINCE, MISSOURI, ARKANSAS, KANSAS, AND OKLAHOMA—SPRINGFIELD PLATEAU AQUIFER

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